

winking like planets, or twinkling like stars; rows of little fires marking the margin of the lowest level of the crater; fire molten in deep *crevasses*; fire in wavy lines; fire, calm, stationary, and restful: an incandescent lake two miles in length beneath a deceptive crust of darkness, and whose depth one dare not fathom even in thought. Broad in the glare, giving light enough to read by at a distance of three-quarters of a mile, making the moon look as blue as an ordinary English sky, its golden gleam changed to a vivid rose-colour, lighting up the whole of the vast precipices of that part of the crater with a rosy red, bringing out every detail here, throwing cliffs and heights into huge black masses there, rising, falling, never intermitting, leaping in lofty jets with glorious shapes like wheat-sheafs, corruscating, reddening, the most glorious thing beneath the moon was the fire-fountain of Mokuaweoweo.*

On the east flank of Mauna Loa, about 4,000 feet in height, is the crater of Kilauea, which, Miss Bird says, has the appearance of a great pit on a rolling plain.

"But such a pit! It is nine miles in circumference, and its lowest area, which not long ago fell about 300 feet, just as ice on a pond falls when the water below it is withdrawn, covers six square miles. The depth of the crater varies from 800 to 1,100 feet in different years, according as the molten sea below is at flood or ebb."

We wish we had space to quote Miss Bird's fearfully vivid description of what she saw during the two visits she made to Kilauea, descriptions which, were they not evidently written on the spot with a truthful pen, would almost deserve to be called sensational.

She also made the ascent of Mauna Kea, to the north of Mauna Loa, the highest peak in Oceania, perpetually covered with snow, a dead volcano, whose top consists of deep soft ashes and sand.

On the west side of Hawaii is another extinct volcano, Hualulai, 10,000 feet high, which has only slept since 1801, when there was a tremendous eruption from it, which flooded several villages, destroyed many plantations and fish-ponds, filled up a deep bay twenty miles in extent, and formed the present coast.

The largest extinct volcano in the world, Haleakala, is in the centre of the island of Maui, lying to the north-west of Hawaii. It is 10,200 feet in height; its terminal crater is nineteen miles in circumference, 2,000 feet deep, and contains numerous subsidiary cones, some of which are 800 feet high. Miss Bird of course visited it, and, as usual, her description is exceedingly graphic and full, and is considerably helped out by an excellent map of the crater. It seems that very few of the usual volcanic products are present in this extinct crater.*

Volcanic action in the Sandwich Islands would seem to have died out from west to east; this is inferred from the state of the lava and the great depth of soil in some of the western islands, as in Oahu and Kauai, the latter the most westerly of the inhabited islands. Some very remarkable instances of the powerful effects of weathering in causing degradation are to be seen in this island. The Punchbowl, a crater behind Honolulu, was in 1786 observed to be composed of high peaks; but atmospheric influences have reduced it to the appearance of a single wasting tufa cone; and the cone of Diamond Hill, to the

south of the town, is also, from the same causes, rapidly diminishing.

The native population of the Sandwich Islands, which belongs to the Malay or Malyo-Polynesian division of Oceania, is fast dying out, at the fearful rate of something like 1,000 per year; so that unless some counteracting circumstances intervene, it must in a very few years become entirely extinct. Cook calculated the population of the islands in 1778 to be about 400,000; now the native population is under 50,000. That the decay is to a considerable extent owing to contact with whites there is no doubt.

But when every allowance is made for the effects of such contact upon the native population, it is questionable whether this will account completely for its rapid decrease. A similar decrease seems to be going on all over the Pacific islands, even in places where the whites have always been extremely few. From this point of view M. Leborgne has recently turned his attention to the small Gambier group, which consists of four islands. Magaréva, the most important island, had in 1840 a population of 1,130; it is now only 650. Dr. Hamy, in an article in *La Nature*, ascribes the prevalent diseases mainly to consanguineous marriages, a cause which is likely to obtain in many of the other isolated Pacific groups. This may have something to do with the diminution of the Hawaiian population, as also the fact that the careless, happy, and extremely sociable people seem to be almost devoid of anything like parental affection, taking little care of their children, and readily parting with them to anyone willing to take them; the consequence is that a large proportion die in infancy. Another point to be noted is that in 1872 the males exceeded the females by 6,400 souls.

At all events there is no doubt that the populations of most of the Pacific islands are rapidly disappearing, and that ere very long the only tenant of their lovely homes will be the omnipresent white man, who has foisted on them an exotic civilisation which seems to have unmanned them, to have completely checked their natural development, and whose invariable concomitants have been disease and widespread destruction.

We again recommend Miss Bird's most attractive book to the favourable notice of our readers. A small map of the islands is prefixed, and the few illustrations are beautifully executed.

OUR BOOK SHELF

Sun and Earth as Great Forces in Chemistry. By Thos. W. Hall, M.D. (London: Trübner and Co.)

THE author of this work, professing himself the preacher of a new doctrine, theorises, to use his own words, "on the phenomena of chemistry . . . considering the whole of chemistry as but heat acting on matter." The sun is considered to exert some subtle chemical influence on matter, but, unfortunately for science, these effects, we are told, cannot be studied experimentally, "yet we can do so theoretically to a very useful extent." After carefully perusing the twelve chapters in which this eminently theoretical treatment is carried out, we are driven to ask ourselves whether Dr. Hall's views are not more of the nature of complication than of explanation. It may be safely affirmed that the phenomena of chemistry are far more easily explained by existing theories—imperfect though they be—than by the obscure reasoning based on perfectly gratuitous assumptions in which the present

* According to Mr. Brigham, the products of the Hawaiian volcanoes are native sulphur, pyrites, salt, sal ammoniac, hydrochloric acid, hematite, sulphurous acid, sulphuric acid, quartz, crystals, palagonite, feldspar, chrysolite, Thompsonite, gypsum, solfatarite, copperas, nitre, arragonite, Labradorite, limonite.

volume abounds. Neither is the work free from the grave charge of inaccuracy. The writer who speaks of the sun as an "everlasting, universal, equable heat source," cannot be acquainted with Sir Wm. Thomson's paper on the dissipation of energy. On page 37 the equivalent of iodine is stated to be 125; on page 46 we are told that potassium is negative to sulphur. It will be new to our readers to learn (p. 50) that "attraction in chemistry does not differ from that in physics," and that carbon disulphide is prepared (p. 52) by powdering, mixing, and heating carbon with sulphur. On page 108 we are informed that "latent heat is, by the study of galvanism, resolvable into electricity." We do not differ from Dr. Hall in considering the following idea of the cause of electro-magnetism as "most rudimentary and rough." Speaking of a solenoid, the author states (p. 116), "Such a solenoid or its latent-heat current will avoid the latently hot parts of the earth—that is, her equator—and will place itself at right angles to the equator—that is, move away from the equator as far as it can; will, in fact, assume a position parallel to the magnetic meridian of the place, &c." The phraseology adopted by Dr. Hall must be characterised as eminently original; we select a few expressions to submit to the judgment of our readers:—"Proto-metalloidations," "nitridations," "hydro-soluble," "tensified, unmorphigenic electroid," "disoccupied," "very unnegative hydrogen," "hydrohalogenic acid," "equo-terro-solar equilibrium," "protometalloidid," "dis-equilibrium." The description of the combustion of carbon is perhaps worth quoting entire:—"Carbon combines with oxygen, leaves its solid shape for a gaseous one, forming carbonic anhydrid gas, and this greatly because of carbon's own heat constitution; and, further, because of the intense nearness of the oxygen to carbon and our earth's comparative distance; this because also of the excellent heat capacity of oxygen itself: and thus carbon with oxygen leaps up into carbonic anhydrid gas, earth loosened into the highest sun forms, approaching that of oxygen itself, for the heat capacities of carbon are near those of oxygen: but the oxy-terric struggle for carbon is arduous; our earth has greatly in her favour her immensity, but then she is far off, and her forces decrease with distance; but even so, for freeing carbon from our earth's control, oxygen requires always, as we know, the further assistance of heat on carbon; we always, for oxy-carbonic combination, have to set fire to carbon." On p. 34 we are gravely informed that potassium, even under naphtha, is acted upon by sun and earth forces, and becomes covered with an "allotropic crust." The author then goes on to remark that this behaviour arises from the fact that free potassium is "not a child of nature or of our sun, but of furnace heat, and its equilibrium taken with furnace heat must become slowly changed to that of our sun." In the new theory a metallic protoxide is thus formularised: E_xM_1O , "in which E stands for our negative earth, and x for the part she takes in the action not quantitatively known"—we may venture to add, nor yet qualitatively. It would be as tedious as unnecessary to give further quotations in illustration of the manner in which Dr. Hall has handled his subject—the extracts given above will doubtless serve as a caution to readers intending to take up the book. The selections themselves will render further comment a work of supererogation.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

On the Building up of the Tone in the "Gamba" Organ-pipe

IN considering the nature of this pipe, and in determining the relation of its air-reed and its air-column, one fact discovered in

these investigations should always be borne in mind, that the pitch of the reed is dependent not on vibrating length, but on vibrating divergence—on the amplitude of the reed's motion. The pitch of the air-column is not necessarily the same as the pitch of the air-reed; they may be and often are at variance: and this pipe will afford a happy means of demonstration of the statement made in a previous letter, that the tone of every organ-pipe is dual. As regards the reed, whatever the modifications of length by height of mouth, of thickness by varied wind-way, or of strength by amount of wind-pressure, the final result is bound by this law of divergence. In the typical air-reed, any deviation from the direct line of force taken by the stream of air is the beginning of vibration; its highest possible rate of vibration begins existence on its least divergence from the direct line; consequently, its highest pitch is its inceptive tone at this stage or condition of untamed energy. The bass has always been considered the basis and commencement of musical tone; every relation of tones has been examined on that ground, and it has undoubtedly been the source of many errors, one might almost say in the nature of superstitions, so tenacious has been its hold, so blinding its influence on the perceptions. Tone has its beginnings in the highest activity, and descends to the lowest and slowest; the development of its mechanical relations proceeds by definite degrees, and the issue depends on the affinity existing between the pipe and the reed, both possessing definite form, power, and character, and blending these by law. The vibration of the *aëroplastic* reed is thus shown to be *isotonic*, not *isochronous*; the laws of its vibrations are identical with those of the things most like itself, of sound-waves, of light-waves.

It was my good fortune some time ago to have placed in my hands a specimen of a variety of "Gamba" devised by the famous organ-builder, Schulze, of Paulenzelle. The "Gambas" form a class of pipes variously constructed in scale, and they are so called from the quality of their tone imitating the old "Viol da Gamba" and its modern representative the "violoncello." The general characteristics of the class are—cylindrical pipe of comparatively slender scale, low-cut mouth, full-winded at foot, and slow in speaking; the slow speech is a necessity, and is caused by the wind being, as it is technically termed, "much thrown out;" that is, the line of force of the current of wind is set more outward than ordinarily, for without such arrangement the fundamental or ground tone of the pipe would not secure its hold; some harmonic would usurp possession; for the air-reed, being short in consequence of low mouth, and strong from excess of wind, would keep to harmonics as the "flute harmonique" does; the latter has a low languid (or interior level within the mouth), the "Gamba" has a higher languid in relation to the under lip, thus directing the stream at a more oblique angle to that level. The tone has decided introductory and transitive harmonics. Of their sequence, although but momentary, the ear conveys a clear impression to our consciousness. We call it a "stringy quality," and it is a very interesting inquiry how this peculiar pipe-tone is built up. The characteristic quality pertaining to all stringed instruments whose tone is elicited by the bow, does, we may well suppose, arise through a process bearing a close analogy to this.

It is a disadvantage, this slow speech of the "Gamba," often felt to be excessively slow. Most skilful voicing is needful to give sufficient time for the appearance of the introductory harmonics without too greatly delaying the fundamental, for it is a nice point to strike the mean between having the wind so much thrown out that the pipe will not speak any tone, and risking, by giving quicker speech, the sudden "flying off to the octave," with obstinate persistence not to descend.

Take note of this. If you hold your hand or your finger near the mouth of any speaking organ-pipe, there is forthwith a sensible flattening of its pitch, deepening with the nearer approach of the hand; in tuning organs it is the ordinary custom to test pitch by this simple method, determining thereby whether the pipe will best bear flattening for its nearer approximation to a desired pitch or concord with others. Suppose yourself to be tuning a set of "Gamba" pipes: you would notice perchance that a restive pipe continually darting off to harmonics would be corrected and steadily held in check so long as your hand or finger was near or across its mouth. We can thus well understand how it might occur to Schulze that the temporary expedient could be made permanent. This is what Schulze did: he fixed a small bar across the mouth. The device proved successful. In pipes thus treated the tendency of the reed to settle at the octave is suppressed, speech is quickened, more wind may be given without danger, and the quality becomes in con-